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Total Number of Pages : 02

Course: M.Tech
Sub_Code: P1CSBC03

1st Semester Regular/Back Examination: 2022-23

SUBJECT : Advanced Computer Architecture

BRANCH(S): COMPUTER SCIENCE AND ENGG, COMPUTER SCIENCE AND TECH.

Time : 3 Hour

Max Marks : 100

Q.Code : L665

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- Define Instruction Level Parallelism.
- Define RAW, WAW, WAR hazards.
- What are the types of vector processor?
- Write any two differences between Superscalar architecture and Super pipelined architecture.
- Is VLIW a RISC or CISC? Justify.
- Why do we need systolic architecture?
- What are main components of memory management hardware?
- What is meant by anti-dependence? How is it removed?
- What are the disadvantages of using symmetric shared memory?
- Given page reference string: 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6
Find the number of page faults for optimal page replacement algorithm

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Name and explain the different network topologies used in interconnection network architecture.
- Distinguish between typical RISC and CISC processor architectures.
- What do you mean by Speed-Up of pipeline? Derive equations of Speed-Up and Efficiency for Pipeline, Super pipeline, and Super scalar architecture.
- Distinguish between UMA and NUMA architecture.
- Discuss in detail the working of set associative mapped cache with four blocks per set with relevant data. A block-set associative cache consists of a total of 64 blocks divided into 4 blocks sets. The main memory contains 4096 bocks, each consisting of 128 words.
 - How many bits are there in the main memory address?
 - How many bits are there in each of the TAG, SET and WORD fields?

- f) Explain in detail the symmetric shared memory architectures with reference to multiprocessor cache coherence problem.
- g) Consider a 7-stage pipeline processor. In the first stage, instruction is fetched. In the second stage, the instruction is decoded as well as branch target address is computed for branch instructions. In the third stage, the branch outcome is evaluated. Assume 25% of all branches are unconditional branches. Of all the conditional branches, on the average 80% turn out to be taken. Compute the average pipeline stall cycles per branch instruction under pipeline stall, conditional taken, conditional untaken, delayed branch schemes. Ignore structural and data hazards. For delayed branch scheme assume that suitable successor is always found.
- h) What are the different types of Interconnection network used in computer architecture? Compare and contrast between static networks and dynamic networks.
- i) Explain with suitable example LRU page replacement algorithm. Given page reference string: 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6
Find the number of page faults for LRU page replacement algorithm
- j) A CPU generates 32-bit virtual addresses. The page size is 4kB. The processor has a TLB which can hold a total of 256 page table entries. The TLB is an 8-way set associative. Calculate the TLB tag size.
- k) What is cloud computing explain its characteristics and features?
- l) Explain the memory interleaving technique with suitable example.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3 What is instruction-level parallelism? Explain in detail about the various dependences caused in ILP. Explain the techniques to overcome data hazards and control hazards. (16)
- Q4 Describe Flynn's classification of computer architecture. Compare the features of Array Processor and Vector Processors. (16)
- Q5 What is a cache memory? Explain the various mapping techniques of cache memory.
A computer has an 8 GByte memory with 64 bit word sizes. Each block of memory stores 16 words. The computer has a direct-mapped cache of 128 blocks. The computer uses word level addressing. What is the address format? If we change the cache to a 4- way set associative cache, what is the new address format? (16)
- Q6 Explain in detail about data flow computer architecture. Distinguish between static data flow computer and dynamic data flow computer. (16)

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Course: M.Tech
Sub_Code: P1CSBC04

1st Semester Regular/Back Examination: 2022-23
SUBJECT: Advanced Data Structure and Algorithm
BRANCH(S): COMPUTER SCIENCE AND ENGG, COMPUTER SCIENCE AND TECH
Time: 3 Hour
Max Marks: 100
Q.Code: L677

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- What are the applications of pattern matching algorithm?
- Discuss about time complexity of all pairs shortest method.
- Write the differences between spanning tree and minimum spanning tree.
- What is Binary heap?
- How NP-hard problems are different from NP-Complete?
- What is Red- Black Tree?
- Define Binomial Heap.
- Explain the properties of 2-3 trees.
- Define B-tree.
- What are the drawbacks of AVL trees?

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

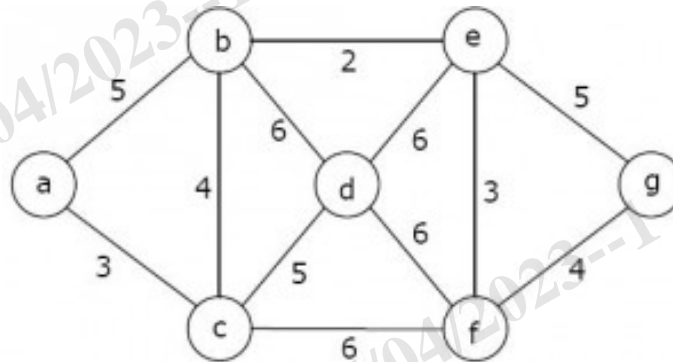
- Define Binomial queue, Binomial tree and Binomial heap.
- Show step by step process for constructing binary heap using the following data 10, 12, 1, 14, 6, 5, 8, 15, 3, 9, 7, 4, 11, 13 and 2.
- Write and explain Floyd-Warshall's algorithm.
- Write and explain Ukonnen's Algorithm.
- Write an algorithm to find number of diagonals in n sided convex polygon.
- Write the algorithm to compute 0/1 Knapsack problem using dynamic programming and explain it.
- Explain the methodology of Dynamic programming. List the applications of Dynamic programming.
- Explain the single source shortest path problem with an example.
- Write an algorithm for 2-3 Tree deletion and discuss its analysis.
- Write and explain Cook's theorem.
- Determine an LCS of $\langle 1, 0, 0, 1, 0, 1, 0, 1 \rangle$ and $\langle 0, 1, 0, 1, 1, 0, 1, 1, 0 \rangle$.
- Solve the recurrence relation: $T(n) = 3T(n/4) + n$

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Four matrices M_1 , M_2 , M_3 and M_4 of dimensions $p \times q$, $q \times r$, $r \times s$ and $s \times t$ respectively can be multiplied in several ways with different number of total scalar multiplications. For example, when multiplied as $((M_1 \times M_2) \times (M_3 \times M_4))$, the total number of multiplications is $pqr + rst + prt$. When multiplied as $((M_1 \times M_2) \times M_3) \times M_4$, the total number of scalar multiplications is $pqr + prs + pst$. If $p = 10$, $q = 100$, $r = 20$, $s = 5$ and $t = 80$, then compute the number of scalar multiplications needed to evaluate the matrix chain $M_1M_2M_3M_4$. **(16)**

Q4 Consider the following graph: **(16)**



Construct a minimum spanning tree using Prim's algorithm? Discuss the time complexity and space complexity of this algorithm.

Q5 Explain the relationship between class P, NP, NP-complete and NP hard problem with example of each class. **(16)**

Q6 Explain three possible cases for inserting a node in the 2-3 Trees? Construct 2-3 Tree with the following data 50, 20, 60, 90, 40, 100, 10. **(16)**

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Course: M.Tech
Sub_Code: P1CSBC05

1st Semester Regular/Back Examination: 2022-23

SUBJECT: Advanced Operating System

BRANCH(S): CSE,CST

Time : 3 Hour

Max Marks : 100

Q.Code : L687

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions :

(2 x 10)

- Differentiate between Monolithic Kernel model and Micro kernel model.
- Define the use of Wait-for graph in Distributed system.
- State two requirements of Mutual Exclusion Algorithms.
- What are the issues to be considered in cache management if the virtual memory page can hold a multiple number of file blocks?
- State two issues in deadlock detection and Resolution in distributed Operating System.
- Distinguish between Physical clock and Logical clock.
- Define orphan message.
- Write any two main advantages of process migration.
- Differentiate between Workstation-server and Processor-pool Model.
- Define Name Space with example.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- State happened before relation in Lamport's Logical clocks. Mention the limitations of Lamport's clock.
- Define casual ordering event. Explain BIRMAN-SCHIPER-STEHENSON Protocol.
- Discuss how Mackawa's algorithm fundamentally differs from other algorithms and what problems it possesses?
- Show how a solution to the consensus problem can be used to solve the interactive consistency problem.
- Explain the sentence, "Consistency, availability and performance tend to be contradictory forces in a distributed file system.
- Explain the architecture of Distributed File system with a neat diagram.
- Differentiated between State and stateless server in distributed File System.
- State different requirements for load distributing.

- i) Identify different types of criteria for selecting a suitable load sharing algorithm.
- j) Define livelocks. What is the difference between a deadlock and a livelock?
- k) Identify different types of system failures.
- l) List the advantages of distributed shared memory.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** a) List the System architecture types used in distributed system. Explain Minicomputer Architecture model with its advantages and disadvantages. (8)
- b) Define distributed Operating system. Explain different issues in distributed Operating systems. (8)
- Q4** a) Differentiated between Token and Non-Token based Algorithm. State different rules for requesting, Executing and releasing critical section in the Ricart – Agarwal Algorithm. (8)
- b) State different types of deadlock detection algorithm in Distributed system. Explain hierarchical deadlock detection algorithms in details. (8)
- Q5** a) Compare and contrast the properties of synchronous and asynchronous Byzantine agreement protocols in distributed systems. (8)
- b) What are the two important goals of distributed file system? Explain the mechanisms for building distributed file systems. (8)
- Q6** a) State the central issues in the implementation of Distributed Shared Memory (DSM). Explain various types of algorithms to implement DSM systems. (8)
- b) Differentiated between Sender and receiver initiated algorithm. Explain different policies of receiver initiated algorithm with its limitations. (8)

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M. Tech
P1PGCC01

1ST Semester Regular/Back Examination: 2022-23

All Specialisations of M.Tech

Time : 3 Hour

Max Marks : 100

Q.Code : L649

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions:

(2×10)

- What is an artificial neuron? And, how is it represented?
- What are the different feed forward networks used in artificial neural network?
- How many bits are needed to encode a binary chromosome if size of population is fixed at 30?
- Differentiate between the objective function and fitness function in the genetic algorithm.
- Give two examples of Hybrid Metaheuristic Optimization Algorithms.
- Differentiate between derivative based and derivative free optimization.
- Briefly explain Cardinality and Relative Cardinality of a fuzzy set with examples.
- What is BFO algorithm? Briefly explain.
- Explain the significance of Lagrange Multiplier in constrained optimization problem.
- Justify: the input and output of a fuzzy logic-based controller are always crisp.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 × 8)

- Solve the following equality constrained optimization method.
Find the dimensions of a box of largest volume that can be inscribed in a sphere of unit radius.
- Explain dynamic programming method of optimization with an example.
- Minimize: $f(x,y,z) = x^2 + y^2 + z^2 + 20x + 10y$, subject to $x \geq 40$, $x+y \geq 80$, $x+y+z \geq 120$. Write the Kuhn-Tucker conditions for the above inequality constrained optimization problem.
- Draw an overview block diagram of a fuzzy control system and explain the function of each of these blocks.
- Draw i) triangular membership function ii) Gaussian Membership Function iii) Trapezoidal Membership Function iv) Generalized Bell Membership Function
- Consider two given fuzzy sets.
 $A = \{1/2, 0.3/4, 0.5/6, 0.2/8\}$, $B = \{0.5/2, 0.4/4, 0.1/6, 1/8\}$
Perform union, intersection, difference, and complement over fuzzy sets A and B .
- Explain PSO algorithm with a flow chart/ step by step algorithm.
- What are the different neural network architectures? Draw the diagram in each type.
- Name the various genetic operators and explain each of these with an example.
- Define and explain Karmakar's Algorithm.
- Differentiate between supervised learning, and unsupervised learning with examples.

- I) Given that $X = \{x_1, x_2, x_3\}$ $Y = \{y_1, y_2\}$ $Z = \{z_1, z_2, z_3\}$ and R and S be two relations defined on universal set $X \times Y$ and $Y \times Z$ respectively. R and S are given

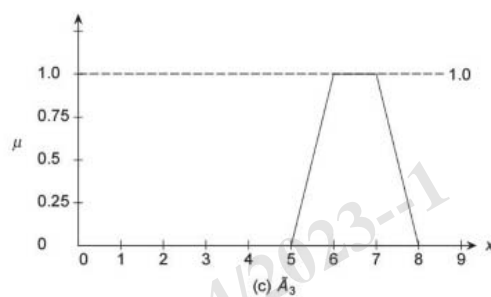
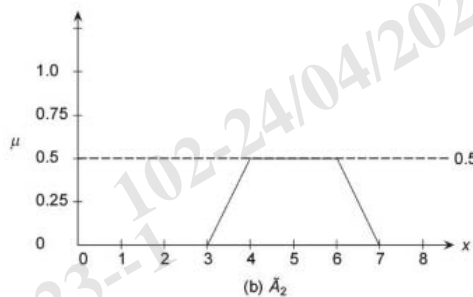
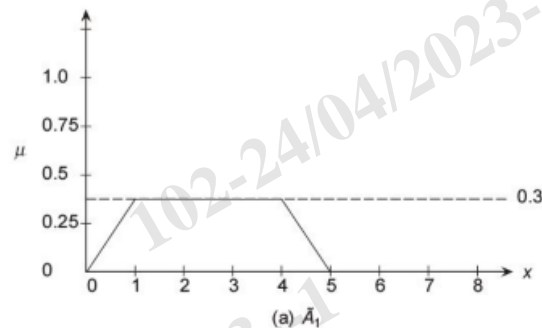
$$\text{as } R = \begin{bmatrix} 0.5 & 0.1 \\ 0.2 & 0.9 \\ 0.8 & 0.6 \end{bmatrix} \quad S = \begin{bmatrix} 0.6 & 0.4 & 0.7 \\ 0.5 & 0.8 & 0.9 \end{bmatrix}$$

Find $R \circ S$, by max-min composition

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** Solve the following linear programming problem using the simplex method: (16)
 Maximize: $Z = 2x_1 - x_2 - x_3$,
 Subject to $3x_1 + x_2 - x_3 \leq 60$, $x_1 - x_2 + 2x_3 \leq 10$, $-x_1 - x_2 + x_3 \geq -20$, $x_1, x_2, x_3 \geq 0$
- Q4** State i) the importance of defuzzification in fuzzy system. (1)
 \tilde{A}_1, \tilde{A}_2 , and \tilde{A}_3 are three fuzzy sets as shown in Fig. (a), (b), and (c) below.
 Find the defuzzification using
 (ii) centroid method, (5)
 (iii) centre of sums method (5)
 (iv) mean of maxima method. (5)



- Q5** Draw a flowchart of the genetic algorithm and explain each component with a suitable example. (16)
- Q6** What components should you consider in order to model an artificial neuron mathematically? Draw a schematic diagram of a multi-layer feed-forward artificial neural network architecture and clearly label the different elements in it. Give one application, where you should apply such an artificial neural network architecture. Explain the basic principle of calculating error in supervised learning. (16)

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Course: M.Tech
Sub_Code: P1PGCC02

1st Semester Regular/Back Examination: 2022-23

SUBJECT: Internet of Things

BRANCH(S): All Specialization

Time : 3 Hour

Max Marks : 100

Q.Code : L652

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- a) IoT is not a single technology. Justify the statement.
- b) Mention the two devices of IoT, which help in interacting with the physical environment.
- c) Define TCP and IP.
- d) What is the significance of application layer in IoT system?
- e) What do you mean by BLE? Explain.
- f) Mention the key differences between IPv4 & IPv6.
- g) List out the features of function model.
- h) List out the four V's in Big Data.
- i) What are the interfaces available in Raspberry?
- j) What is Arduino and how Arduino works?

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- a) Mention the role of IoT in smart city.
- b) Explain in brief about the protocols used for IoT communication.
- c) Briefly explain about wireless sensor network.
- d) Explain, how can edge computing will benefit IoT?
- e) What are the main differences between IoT and M2M?
- f) With neat sketch explain, what are GPIO pins in Raspberry Pi platforms?
- g) Draw and explain the building blocks of IoT device.
- h) Illustrate about various IoT communication APIs.
- i) Explain the WSN. Give examples of WSN used in IoT systems.
- j) Write short notes on SDN and NVF for IoT.
- k) Explain the flow of IoT design methodology.
- l) What is the need of Network? And explain in detail the LAN and WAN.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** Explain in details about IOT networking considerations and the challenges faced. **(16)**
- Q4** Construct the Design of Smart home with Raspberry Pi and other hardware devices with neat sketch. **(16)**
- Q5** Explain in details with sketch and examples for all 6 IoT levels. **(16)**
- Q6** Explain in details about RFID and its significance in IoT. **(16)**